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Description

NON-IGNITION SWITCH VEHICLE IGNITION ENABLING SYSTEM

BACKGROUND OF INVENTION

[0001] The present invention relates to vehicle ignition enabling systems. More particularly, the present invention relates to a system and method of enabling ignition within a vehicle without use of an ignition switch.

[0002] Various types of locks have been used in connection with door locking mechanisms and ignition systems of a vehicle. Traditionally, vehicle door locking mechanisms and ignition systems have operated utilizing a mechanical key. Vehicle operators have used a key in locking or unlocking vehicle doors and in rotating an ignition start, such as an ignition system tumbler, to start a vehicle.

[0003] Recently developed active and passive systems are used in replacement of or to operate in conjunction with the traditional mechanical keyed systems. Active systems refer to systems that require some sort of action by an operator in

order to actuate a locking or start mechanism. An example of an active system is one that uses a remote control to remotely access or start a vehicle, such as those utilizing a keyfob. Passive systems, typically, include an authorization device, such as a smart card, which has a coded signal. An operator merely needs to be within a predetermined range of the vehicle and a vehicle controller checks the coded signal on the authorization device before allowing access thereto.

[0004] The active and passive systems may include anti-theft and anti-tampering mechanisms, which are incorporated to deter unauthorized access to and ignition starting of a vehicle. An example of a device that is considered both an anti-theft device and an anti-tampering device is an electronic interlock. An electronic interlock uses a coded activation signal to enable access to or starting of a vehicle.

[0005] Similar to the smart card system described above, anti-theft systems often include an access device, such as a key or card having a transmitter that transmits an authorization signal. The authorization signal is received by a vehicle controller, which verifies the authorization signal and allows locking mechanisms to be actuated or vehicle ignition to be enabled.

[0006] It has been determined that vehicle operators tend to prefer and have a significant comfort level associated with the use of an active system having a key style mechanism. The comfort level stems from the perceived concept that there exists a higher level of security when a key must be used to access or operate a vehicle rather than simply using a remote or wireless access device. This preference exists even when a higher level of security actually exists for the remote or wireless access device.

[0007] Ignition start mechanical keyed systems typically include a lock assembly having a tumbler that receives a key and is rotated to activate an ignition switch. In operation, an ignition key is inserted into the tumbler, an authorization code may be verified, and the key is than rotated switching the ignition switch to an ignition "ON" state. The tumbler can be complex and costly. Also, the ignition switch can be large in size and costly, depending upon the amount of current passing therethrough.

[0008] Other than the traditional turn key style active ignition system there also exists a non-turn key style active ignition system. In a non-turn key system a key is inserted into a lock assembly, an authorization code is verified, and a separate push button is depressed to enable or start

the vehicle ignition. The push button when depressed either activates an ignition switch or generates an activation signal that is received by a controller in turn starting the engine ignition. Non-turn key systems are generally less preferred due to a lack of rotation of a key and the conventional tactile feel accompanying that rotation.

[0009] It is desirable in designing vehicle systems to minimize the number of components contained therein as well as to minimize system size, weight, and complexity. Thus, there exists a need for an improved active keyed locking system that minimizes system size, weight, and complexity.

SUMMARY OF INVENTION

[0010] The present invention provides an active keyed locking system for a vehicle that includes a keyed actuated device. A position sensor is coupled to the keyed device and generates a position signal indicative of position of the keyed device. A controller is electrically coupled to the position sensor and enables a vehicle component in response to the position signal.

[0011] One of several advantages that is provided by several embodiments of the present invention is the provision of an active turn key locking system without the need for an ig-

nition switch or a key tumbler. In so doing, the present invention minimizes size, cost, and complexity of an active keyed locking system.

[0012] Another advantage provided by an embodiment of the present invention is the provision of an active keyed locking system that not only eliminates the need for an ignition switch, but also provides key authorization to deter theft or unwarranted access to a vehicle. Furthermore, the present invention is versatile in that it may be applied to various lock assemblies and ignition systems.

[0013] Furthermore, it is yet another advantage of an embodiment of the present invention to provide an active keyed locking system with the above-stated advantages that also provides a conventional tactile feel when actuating a key and lock assembly contained therein.

[0014] The present invention is versatile in that it may be applied to various lock assemblies and ignition systems.

[0015] The present invention itself, together with further objects and attendant advantages, will be best understood by reference to the following detailed description, taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF DRAWINGS

[0016] For a more complete understanding of this invention ref-

erence should now be had to the embodiments illustrated in greater detail in the accompanying figures and described below by way of examples of the invention wherein:

[0017] Figure 1 is a perspective and block diagrammatic view of an active keyed locking system for a vehicle in accordance with an embodiment of the present invention.

[0018] Figure 2 is a block diagrammatic view of an active keyed locking system in accordance with an embodiment of the present invention.

[0019] Figure 3 is a perspective view of a key, having a key cylinder non-insertable antenna, and a lock assembly utilizing a single coil configuration in accordance with an embodiment of the present invention.

[0020] Figure 4 is a cross-sectional view of the key of Figure 3 and a corresponding base station in accordance with another embodiment of the present invention.

[0021] Figure 5 is a perspective view of a key and a corresponding base station utilizing a dual coil configuration in accordance with another embodiment of the present invention.

[0022] Figure 6 is a cross-sectional view of a key having a key cylinder insertable antenna, a corresponding base station,

and a key locking device in accordance with another embodiment of the present invention.

[0023] Figure 7 is a cross-sectional view of a key and a corresponding base station utilizing a key recognition assembly in accordance with another embodiment of the present invention.

[0024] Figure 8 is a cross-sectional view of a key having a body mounted key cylinder insertable antenna, a corresponding base station, and a key locking device in accordance with another embodiment of the present invention.

[0025] Figure 9 is a cross-sectional and perspective view of a key and a corresponding base station having a potentiometer/encoder style position sensor in accordance with another embodiment of the present invention.

[0026] Figure 10 is a cross-sectional view of a key and a corresponding base station having a key antenna within a lock assembly in accordance with another embodiment of the present invention.

[0027] Figure 11 is a front cross-sectional view of a lock assembly having multiple magnetic structures in accordance with another embodiment of the present invention; and.

[0028] Figure 12 is a logic flow diagram illustrating a method of enabling at least one vehicle component through use of

an active keyed locking system in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

[0029] In the following figures the same reference numerals will be used to refer to the same components. While the present invention is described with respect to a system and method of enabling ignition within a vehicle without use of an ignition switch, the present invention may be adapted and applied in various locking assemblies and systems including ignition systems, door locking systems, as well as other active keyed locking system applications. The present invention may be applied to trunks, hoods, glove compartments, storage units, ignition start devices, and other devices that have a lock assembly.

[0030] In the following description, various operating parameters and components are described for one constructed embodiment. These specific parameters and components are included as examples and are not meant to be limiting.

[0031] Although for simplicity, the following description is primarily directed to an active keyed locking system as applied to an ignition start or ignition lock assembly, the present invention as stated above may be applied to various other lock assemblies known in the art.

[0032] Also, in the following description the term "vehicle component" may refer to any component or system of components within a vehicle. For example, a vehicle component may refer to a stereo, an air-conditioning system, one or more lights, an ignition system, a lock, a seat system, an overhead console, or other various components or systems within a vehicle.

[0033] Additionally, the term "key" refers to any access, unlocking, or component-starting device that may or may not have a specific identity. A specific identity may be an authorization code, a cut pattern, a magnetic field of a predetermined strength, or other identification parameter known in the art. A key may be active, such that it generates a transmission signal or magnetic field. A key may be passive such that it simply has a specific cut pattern, size, length, style, reflective pattern, bar code, or other passive identification or authorization parameter known in the art. A key may be a keyfob with an insertable portion that may be inserted into a lock assembly. A key may be of various sizes, shapes, styles, and forms as are known in the art. A few examples of a key are provided in the following description.

[0034] Referring now to Figure 1, a perspective and block dia-

grammatic view of an active keyed locking system 10 for a vehicle 12 in accordance with an embodiment of the present invention is shown. The active system 10 includes one or more keys 14 (only one is shown), one or more lock assemblies 16, one or more base stations 18 (only one is shown), and a main controller 20. Further examples of keys are shown in Figures 3-10. The lock assemblies 16, in the embodiment as shown, include a door lock assembly 22 and an ignition lock assembly 24. The base station 18 enables access to or ignition of one or more vehicle components upon identification, authorization, and position determination of the keys 14. Position sensors 26 are coupled between the lock assemblies 16 and the base stations 18. The lock assemblies 16 may be located within the base stations 18.

[0035] For example, the lock assemblies 16 may have any number of rotational or translational positions, each position corresponding to an activation of one or more vehicle components. Upon inserting and actuating the keys 14 in one of the lock assemblies 16 the base stations 18 identify, authorize, and determine the position of the keys 14. When the keys 14 have been authorized the main controller 20 enables one or more vehicle components in re-

sponse to the key positions. The keys 14 may even be in the form of a toggle switch having several different positions, such that the keys, upon being inserted into the lock assemblies, may be toggled into the different positions. For simplicity, the present invention is primarily described with respect to rotationally actuated keys and lock assemblies, although other actuatable keys and lock assemblies may be used.

[0036] The base stations 18 may generate an ignition signal that is received by the main controller 20, which in turn starts the ignition of an ignition system 28. The base stations 18, the main controller 20, and the ignition system 28 receive power from a vehicle power source 30.

[0037] The active system 10 may utilize various techniques in identifying and authorizing the keys 14. For identification the active system 10 may utilize an infrared transmitter 40 and an infrared detector 42, as shown in Figure 7. The activation system 10 in identifying a key may also utilize various switches, magnetic field sensors, or other sensors or identification techniques known in the art. For authorization the active system 10 may utilize various modulation or coded signal techniques known in the art, such as the coded technique described with respect to Figure 2.

[0038] In the following Figures various alternative examples are provided for the keys 14, the lock assemblies 16, and the base stations 18.

[0039] Referring now to Figure 2, a block diagrammatic view of an active keyed locking system 10^{I} in accordance with an embodiment of the present invention is shown. The active system 10^{I} includes a key 14^{I} and a base station 18^{I}. In the embodiment of Figure 2, the key 14^{I} is an active key and transmits an authorization signal as well as a position field-altering signal to the base station 18^{I}. The base station 18^{I} verifies the authorization signal and upon verification determines the position of the key 14^{I} in response to the position field- altering signal. The base station 18^{I} in response to the position of the key 14^{I} enables vehicle components, such as accessories or ignition of the ignition system 28.

[0040] The key 14^{I} may include a power source 50, a transponder 52, and a key antenna 54. The power source 50 may be in the form of a capacitor, a battery, or other power source known in the art. The power source 50 may have energy stored therein or may receive energy from an electric field generated by the base station 18^{I}. In general, the power source 50 is not necessary for position detection of the

key 14'. The transponder 52 is used for detection and transmission of authorization signals as well as transmission of position field-altering signals between the key 14' and the base station 18'. The key antenna 54 may be in the form of a conductive coil or in some other antenna form known in the art.

[0041] The base station 18' includes a position sensor 56 for sensing rotational position of a keyed rotationally actuated device 58, such as the key 14' or a key lock assembly component, and generates a position signal in response thereto. An example of a key lock assembly component is a key insert 59, which is shown in Figure 4. A key transceiver 60 is coupled to the position sensor 56 and is used in reception and generation of the authorization signals, as well as in reception of the position signals.

[0042] In one embodiment of the present invention, a signal conditioner 62 and a base station controller 64 are coupled to the transceiver 60. The signal conditioner 62 may include amplification and rectification circuitry (not shown). The controller 64 receives the authorization signals directly from the transceiver 60 and receives the position signals via the signal conditioner 62 through an analog-to digital converter 66. The authorization signals are in a digital

format whereas the position signals are in an analog format. Of course, the authorization signals and the position signals may be in various formats known in the art. Upon authorization and appropriate ignition position enablement of the key $14'$, the base station controller 64 generates an ignition signal. The ignition signal is received by the main controller 20, which in turn starts ignition within the ignition system 28.

[0043] The position sensor 56 may be of various type and style known in the art. The position sensor 56 may be in the form of one or more antennas, such as one or more conductive coils. The position sensor 56 may be infrared based, electromagnetic based, resistive or current based, or based on some other sensing technique known in the art. The position sensor 56 may be in the form of a series of magnets, a coil, a potentiometer, an encoder, an optical sensor, an infrared sensor, a hall effect sensor, a rotary variable differential transformer, a rotary variable inductance transducer, an angular position sensor, or a resolver, as is shown in Figure 9.

[0044] The main controller 20, the transponder 52, and the base station controller 64, may be microprocessor based such as a computer having a central processing unit, memory

(RAM and/or ROM), and associated input and output buses. The main controller 20, the transponder 52, and the base station controller 64 may be application-specific integrated circuits or may include other logic devices known in the art. The main controller 20 and the base station controller 64 may be a portion of a central vehicle main control unit, an interactive vehicle dynamics module, or may be stand-alone controllers as shown.

[0045] Referring now to Figures 3 and 4, perspective and cross-sectional views of a key 14^{II}, having a key cylinder non-insertable antenna 70, a lockset or lock assembly 16^{I}, and a base station 18^{II} utilizing a single coil configuration in accordance with an embodiment of the present invention are shown. The key cylinder non-insertable antenna 70 is located within a body section 72 and not within an insertable section 74 of the key 14^{II}. Position sensors 56^{I} and 56^{II} may be in the form of conductive coils, as shown, or may be in some other form, as is further stated below. The position sensor 56^{I} resides around the lock assembly 16^{I}, whereas the position sensor 56^{II} resides within a base station 18^{II} and in close proximity to the insert 59.

[0046] As the key 14^{II} is rotated, a magnetic field generated by the position sensors 56^{I} and 56^{II} directly changes corre-

sponding to the rotational position of the key 14^{II}. For example, the transponder 52 may generate a modulation signal that is transmitted by the key antenna 70. As the key 14^{II} is rotated, magnetic field generated by the position sensors 56^{I} and 56^{II} is affected by the modulation signal, which causes change in amplitude of the magnetic field. The change in the magnetic field is detected by the transceiver 60. In another example, a base signal in the form of a modulated magnetic field is generated by the position sensors 56^{I} and 56^{II} and is altered by the proximate positioning and translating of the key antenna 54. Position of the key 14^{II} is determined in response to the alteration of the base signal.

[0047] The key insert 59 resides within the base station 18^{II} and is rotationally translatable relative to a base station housing 76. A resistive element 78, such as a spring or the like, may be coupled between the insert 59 and the base station housing 76 to provide a traditional rotational tactile feel to the key 14^{II} during actuation thereof. The resistive element 78 may be mechanical or electrical in nature. The element 78 is illustrated in Figure 4. Other known resistive elements may be used in replacement of or in combination with the resistive element 78.

[0048] In another embodiment of the present invention the key 14^{II} does not have the key antenna 70, but rather simply a field-altering device 80, such as a magnetic device, located within the insertable section 74. The position sensors 56^{I} and 56^{II} are used to generate a magnetic field. As the key 14^{II} is rotated, the field-altering device 80 alters the magnetic field generated by the position sensors 56^{I} and 56^{II}, thereby, indicating position of the key 14^{II}. The field-altering device 80 may be formed of a ferrous material or other magnetic material known in the art.

[0049] Referring now to Figure 5, a perspective view of a key 14^{II} and corresponding base station 18^{III} utilizing a dual coil configuration in accordance with another embodiment of the present invention is shown. The base station 18^{III} includes a position sensor 56^{III} in the form of a pair of antennas or coils 81, each of which being mounted on a side 82 of the lock assembly 16^{I}. The coils 81 are mounted approximately 90° relative to each other. The dual coils 81 are used, as opposed to a single coil, to increase rotational position differentiation. Magnetic field differences between the coils 81 may be monitored and interpolation may be performed therebetween to better determine position of the key 14^{II}. Any number of coils may be utilized.

[0050] Referring now to Figure 6, a cross-sectional view of a key 14^{III} having a key cylinder insertable antenna 84, and a corresponding base station 18^{IV} with a key locking device 86 in accordance with another embodiment of the present invention is shown. The insertable antenna 84 is located within an insertable section 74^{I}. By having the insertable antenna 84 within the insertable section 74^{I}, amplitude changes within the magnetic field that are generated by the transceiver 60 are increased, in effect increasing the position differentiation capability of the active system 10. The insertable section 74^{I} and the base station 18^{IV}, in combination, provide the locking device 86. The locking device 86 may be in various forms known in the art. The locking device 86 may include a detent 88, within the insertable section 74^{I}, and a protruding member 90. The protruding member 90 may extend from an insert 59" into the detent 88, as shown. The locking device 86 may also include other components to lock the key 14^{III} in a position relative to a lock assembly 16^{II}, such as a spring, a plunger, a latch, or other locking device components known in the art. The locking device 86 may also be used for key identification, an example of which is provided by the embodiment of Figure 8.

[0051] The position sensor 56^{IV} is located within the base station 18^{IV} such that it is in direct alignment with the insertable antenna 84, when inserted in the lock assembly 16^{II}. The direct alignment of the position sensor 56^{IV} with the insertable antenna 84 provides increased position signal differentiation and thus increased position differentiation of the key 14^{III}. Additional example embodiments illustrating alignment between key antennas or insertable antennas and position sensors are shown in Figures 7 and 8.

[0052] Referring now to Figure 7, a cross-sectional view of a key 14^{IV} and a corresponding base station 18^{V} utilizing a key recognition assembly 92 in accordance with another embodiment of the present invention is shown. A lock assembly 16^{III} includes the infrared transmitter 40 and the infrared receiver 42. When the key 14^{IV} is inserted into the key assembly 16^{III} infrared light passing between the transmitter 40 and the receiver 42 is affected, allowing the base station controller 64 to recognize or identify the key 14^{IV}. Upon recognition of the key 14^{IV} the base station controller 64 initiates operation of the active system 10. The transmitter 40 and the receiver 42 may also be used in authorization of the key 14^{IV} through use of various techniques known in the art.

[0053] Note that a body and an insertable section of a key may be of various sizes, shapes, and styles; another example of which is illustrated by the body 72^{I} and the insertable section 74^{I} of the key 14^{IV}. Similarly, a lock assembly and a base station may also be of various sizes, shapes, and styles to accommodate for the various sizes, shapes, and style keys.

[0054] Referring now to Figure 8, a cross-sectional view of a key 14^{V} having a body mounted key cylinder insertable antenna 84^{I}, and a corresponding base station 18^{VI} with a key locking device 86^{I} in accordance with another embodiment of the present invention is shown. The insertable antenna 84^{I} is located within a body 72^{II} rather than within an insertable section 74^{II} of the key 14^{V}, as with insertable antenna 84 of Figure 7. As stated above, the position sensor 56^{II} is located within the base station 18^{VI} and is in direct alignment with the insertable antenna 84^{I} when the key 14^{V} is inserted into a lock assembly 16^{IV}.

[0055] The locking device 86^{I} may be in various forms. The locking device 86^{I} is coupled to a recognition switch 94. The recognition switch 94 is in an "ON" position when the key 14^{V} is inserted into the lock assembly 16^{IV}. The base station controller 64 is coupled to the switch 94. The base

station controller 64 activates operation of the active system 10 in response to the state of the switch 94.

[0056] Referring now to Figure 9, a cross-sectional and perspective view of a key 14^{VI} and corresponding base station 18^{VII} having a potentiometer/encoder style position sensor 96 in accordance with another embodiment of the present invention is shown. Insertable section 74^{III} of the key 14^{VI} is cylindrically shaped having an inner surface 98 and an outer surface 100. The position sensor 96 resides within a lock assembly 16^{V} and has a rotational member 102 that extends from the potentiometer/encoder 96. The insertable section 74^{III} slides over the rotational member 102 and locks thereto via a key locking device 86^{II}. As the key 14^{VI} is rotated, position of the key 14^{VI} is determined in response to a position signal generated by the position sensor 96. The position signal may be generated using various potentiometer and encoder position measuring techniques known in the art.

[0057] Referring now to Figure 10, a cross-sectional view of a key 14^{VII} and a corresponding base station 18^{VIII} with a key antenna 104 in accordance with another embodiment of the present invention is shown. A lock assembly 16^{VI} includes the key antenna 104 as opposed to the key an-

tenna 104 being located within the key 14^{VII}. Therefore, the key 14^{VII} is passive with respect to the position related components. All active position determination related components are located within the lock assembly 16^{VI} and the base station 18^{VIII}. The key 14^{VII} may include the authorization devices 110, such as the transponders and the key antennas described above, for key authorization.

[0058] The lock assembly 16^{VI} in combination with the key 14^{VII} provide a key locking device 86^{III}, such that when the key 14^{VII} is inserted into the lock assembly 16^{VI} they are locked or fixed in relative position to each other. The lock assembly 16^{VI} rotates simultaneously and in unison with the key 14^{VII}. Thus, by rotating the key 14^{VII} one also rotates the lock assembly 16^{VI} and the key antenna 104 contained therein. Rotation of the key antenna 104 alters a position signal generated by a position sensor 56^{V}.

[0059] A pair of contacts 106 exists for electrical coupling between the key antenna 104 and a transponder 108 or the like, which is located within the base station 18^{VIII}. The transponder 108 may be similar to the transponder 52 or may be coupled to or incorporated in the base station controller 64.

[0060] Referring now to Figure 11, a front cross-sectional view of

a lock assembly 120 having multiple magnetic structures 122 in accordance with another embodiment of the present invention is shown. In determining position of a key, various signal modulation techniques may be used including amplitude modulation, frequency modulation, phase modulation, and other modulation techniques known in the art or a combination thereof. The embodiment of Figure 11 is directed towards a frequency modulation technique.

[0061] As a key is rotated after being inserted into the lock assembly 120, due to varying size and/or magnetic field strength of the magnetic structure 122, frequency of a position signal is altered. The variance in frequency may be detected and since the amount of frequency variation is directly proportional to the rotational position of the key, the key position may be determined. The frequency modulation technique described above is just one possible frequency modulation example, other frequency modulation techniques may be utilized.

[0062] The magnetic structures 122 may have varying magnetic field strength and varying size and length. The magnetic structures may be formed of various magnetic materials known in the art.

[0063] Referring now to Figure 12, a logic flow diagram illustrating a method of enabling at least one vehicle component through use of the active system 10 in accordance with an embodiment of the present invention is shown. Although the following steps are described with respect to the embodiments of Figures 2-8, the steps may be easily modified to be applied to other embodiments of the present invention.

[0064] In step 120, the key 14^{I} is inserted into a lock assembly 16. In step 122, a recognition device, such as the transmitter 40 and the receiver 42 or the switch 94 of Figures 7 and 8, generates a recognition signal. In step 124, the base station controller 64 in response to the recognition signal enables the active system 10 including the base station 18^{I} and the components contained therein.

[0065] In step 126, the base station controller 64 signals the transceiver 60 to generate a first authorization signal. In one embodiment of the present invention the first authorization signal is in the form of a modulated carrier signal. In step 128, the transponder 52 in response to the first authorization signal generates a second authorization signal. In step 130, the base station controller 64 verifies the code of the second authorization signal with that of a

predetermined code, which may be stored within the base station controller 64. When the second authorization code is deemed correct the base station controller 64 proceeds to step 132.

[0066] In step 132, the position sensor 56 generates a position signal in response to the rotational position of the key 14^{I}. A position sensor may determine position of a lock assembly, as described with respect to the embodiment of Figure 10. In step 132A, the transceiver 60 generates a base signal, such as a modulated signal or a magnetic field. In step 132B, the key antenna 54 may be rotated altering the base signal; the change in amplitude forms the position signal. The base signal may be altered in amplitude, frequency, phase, by some other signal parameter known in the art, or by any combination thereof.

[0067] In one embodiment of the present invention, the lock assembly has three rotationally selectable positions. When the key 14^{I} is in a first position, corresponding to non-enablement of any vehicle components, amplitude of the position signal is at a minimal level. When the key 14^{I} is in a second position, corresponding to enablement of vehicle accessories, amplitude of the position signal is at a midlevel. When the key 14^{I} is in a third position, corre-

sponding to enablement of ignition within the ignition system 28, amplitude of the position signal is at a maximum level.

[0068] In step 134, the base station controller 64 monitors change, such as change in amplitude or frequency, in the base signal or the position signal and in response thereto determines rotational position of the key 14^{I}. In step 136, the base station controller 64 generates a component enablement signal, which is received by the main controller 20. In step 138, the main controller 20 enables one or more vehicle components, such as for example enablement of ignition within the ignition system 28, in response to the component enablement signal.

[0069] The above-described steps are meant to be illustrative examples; the steps may be performed sequentially, synchronously, simultaneously, or in a different order depending upon the application.

[0070] The present invention provides an active keyed locking system that eliminates the need for a key tumbler and an ignition switch, as are traditional used in prior active locking systems. Although the present invention eliminates the use of a key tumbler and an ignition switch it provides a traditional tactile feel and resistance in regards to key

actuation. The active keyed locking system of the present invention is simple in design, minimizes number of system components, lightweight, and inexpensive to manufacture.

[0071] While the invention has been described in connection with one or more embodiments, it is to be understood that the specific mechanisms and techniques which have been described are merely illustrative of the principles of the invention, numerous modifications may be made to the methods and apparatus described without departing from the spirit and scope of the invention as defined by the appended claims.